Problem Behaviour and Traumatic Dental Injuries in Adolescents

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ABSTRACT

Aim: To explore the relationship between problem behaviour and traumatic dental injuries (TDI) among 15-16 year old schoolchildren from East London.

Methods: This cross-sectional study used data from 794 adolescents who participated in Phase III of the Research with East London Adolescents Community Health Survey (RELACHS), a school-based prospective study of a representative sample of adolescents. Participants completed a questionnaire and were clinically examined for TDI, overjet and lip coverage. The Strength and Difficulties Questionnaire (SDQ) was used to assess problem behaviour, which provided a total score and five domain scores (emotional symptoms, conduct problems, hyperactivity, peer problems and pro-social behaviour). The association between problem behaviour and TDI was assessed in unadjusted and adjusted logistic regression models. Adjusted models controlled for demographic (sex, age and ethnicity), socioeconomic (parental employment) and clinical factors (overjet and lip coverage).

Results: The prevalence of TDI was 17% and the prevalence of problem behaviour, according to the SDQ, was 10%. In the adjusted model, adolescents with problem behaviour were 1.87 (95% Confidence Interval: 1.03 to 3.37) times more likely to have TDI than those without problem behaviour. In subsequent analysis by SDQ domains, it was found that only peer problems were associated with TDI (OR=1.78, 95%CI: 1.01-3.14), even after adjustment for confounders.

Conclusion: This study found evidence for a relationship between problem behaviour and TDI among adolescents, which was mainly due to peer relationship problems.

INTRODUCTION

Traumatic dental injuries (TDI) result from the complex interplay between environmental, psychological, behavioural and biological processes (1, 2). The above factors are often associated together to increase the risk of accidental injury resulting in TDI (2, 3). However, most research on the factors associated with TDI has focussed on demographic characteristics, such as gender and age; socioeconomic position, such as education, occupation and household income; and oral predisposing factors, such as size of anterior overjet with protrusion and lip coverage.

Childhood psychological difficulties, including stress, bullying, and behaviour and emotional problems, may have a role in the development of TDI. Problem behaviour has been defined as "behaviour that is socially defined as a problem, a source of concern, or as undesired by norms of conventional society and its occurrence usually elicits some kind of a social response, for example hostile aggression against peers, vandalism and hyperactivity" (4). Problem behaviour occurs as a result of biological and environmental factors that interact with complexity. They are common and vary in type and severity (5, 6) and are often distressing for the individual, family and carers (7, 8).

Previous studies have drawn out links between behaviour problems and accidents among adolescents. A series of studies used data from the 1997 Health Survey for England to explore behavioural and emotional factors associated with involvement in accidents among children aged 4 to 15 years (9-11). The authors first found that high scores in hyperactivity, as measured by the Strengths and Difficulties Questionnaire (SDQ), were significantly associated with the occurrence of minor accidents, major accidents, and major accidents involving vehicles, whereas high scores in emotional problems were associated with minor accidents (9). The authors also showed that children scoring high in hyperactivity and conduct disorder had greater odds of reporting a major injury affecting the head region (10). Furthermore, hyperactivity was significantly associated with the occurrence of major injuries affecting the face and/or teeth (11). A case-control study in Brazil found that adolescents with a major injury were more likely to have abnormal scores on the SDQ total score compared to normal status adolescents. By SDQ domains, only conduct and emotional problems remained significantly associated with reporting a major injury (12). And in Greece, schoolchildren with abnormal scores in the SDQ total score, conduct disorders and hyperactivity were more prone to minor accidents and serious accidents requiring emergency room attendance. In addition, abnormal

score in the SDQ total score, conduct disorders, hyperactivity and peer-problems were important risk factors for the most serious accidents leading to hospital admission.

The only previous study linking problem behaviour and TDI found that not all types of problem behaviour may be related to TDI (13). This hospital-based matched case-control study of 170 children aged 7-15 years reported that children with TDI were around 3 times more likely to report peer relationship problems than controls. Further evidence is needed to corroborate or refute these initial findings. Therefore, this study assessed the relationship between problem behaviour and TDI among 15-16 year old adolescents in East London.

MATERIALS AND METHODS

Study population

The Research with East London Adolescents Community Health Survey (RELACHS) is a longitudinal school-based study of a representative, ethnically diverse sample of 2790 adolescents attending 28 state secondary schools in East London, United Kingdom (14, 15). The study area is characterized by generally high levels of socio-economic deprivation. In addition, the population is ethnically very mixed, with a large proportion from a number of different 'non-White' ethnic groups (16). RELACHS included three cross-sectional surveys of adolescents from year 7 (11-12 years) in 2001 (phase I), year 9 (13-14 years) in 2003 (phase II), and year 11 (15-16 years) in 2005 (phase III). Adolescents were selected using a stratified two-stage cluster sampling in 2001. All 42 eligible schools in the boroughs of Hackney, Tower Hamlets and Newham were initially stratified by borough and school type (comprehensive, voluntary and other). Thirty schools were randomly selected and balanced to ensure representation by single- and mixed-sex. In each of the 28 schools that agreed to participate, two representative mixed ability classes from year 7 were selected (15). The present study will use data from RELACHS phase III only, where oral health data were collected.

Ethical approval was obtained from the East London and City Local Research Ethics Committee. Written informed consent was sought from each school's head teacher and from each adolescent. Parents were fully informed about the study and given the opportunity to opt out.

A minimum sample size of 397 adolescents (40 with and 357 without problem behaviour, 10% and 90% of the sample, respectively) was required to estimate an odds ratio of 3 for the association

between problem behaviour and TDI (13), assuming that 17% of adolescents without problem behaviour have TDI (17), with 80% statistical power and 95% confidence level.

Data collection

In RELACHS phase III, data were collected using questionnaires and clinical examinations. Questionnaires were completed individually in classrooms under supervision of trained researchers, who addressed adolescents' queries and check questionnaires for missing data. Participants' provided information on their demographic characteristics (sex, age and ethnicity), socioeconomic measures and problem behaviour. Ethnicity was self-assigned using an adaptation of the 2001 UK census categories, which included 24 possible categories under five main ethnic groups: White, Asian, Black, Mixed and Other. Family socioeconomic measures included parental employment (both employed, one unemployed, both unemployed), household overcrowding (>1.5 persons/room) and family car ownership. In addition, adolescents' eligibility for free school meals was obtained from school records. It has been previously shown that parental employment was the most sensitive socioeconomic indicator in this sample (17).

Adolescents' problem behaviour was measured using the Strengths and Difficulties Questionnaire (SDQ), developed by Goodman (18). The SDQ is composed of 25 items; 10 strengths, 14 difficulties and one neutral item. The 25 items are divided into five scales of fives items each namely Emotional Symptoms, Conduct Problems, Hyperactivity, Peer Problems and Prosocial Behaviour. Participants' responses were collated on 3-point ordinal scales, coded as 0 'not true', 1 'somewhat true' and 2 'certainly true'. Each domain score was calculated by adding responses to individual items and could therefore range between 0 and 10. The total score was calculated by adding all scale scores except for prosocial behaviour, with the SDQ total score ranging from 0 to 40. SDQ total and domain scores were dichotomised to identify cases with problem behaviour. The total SDQ score was divided into deciles, and adolescents in the top decile (i.e. those with the highest scores in the sample) were regarded as cases (code 1). The remaining participants were regarded as non-cases (code 0). For the SDQ domains, participants in the top decile for scores on Emotional Symptoms, Conduct Problems, Hyperactivity and Peer Problems as well as those in the bottom decile for scores on Prosocial behaviour score were regarded as cases. This was done separately for each domain (18).

Oral clinical examinations were conducted according to the WHO methodology (19). Two trained and calibrated examiners (GS and PE) carried out the oral clinical examinations with adolescents seated on an adjustable chair. Participant's teeth were not brushed or professionally cleaned prior to examination. Teeth were dried with cotton pellets and examined with a plane mouth mirror under illumination with Daray light lamps. Diagnosis of tooth condition was visual and no radiographs were taken. TDI experience was recorded according to the classification described by Glendor, Marcenes and Andreasen (1). Oral predisposing factors were also measured during clinical examinations. Overjet was recorded as increased if it was greater than 6 mm (20) whereas lip coverage was recorded as adequate if the lips were able to contact one another without strain when the mandible is in rest position (21).

A training and calibration exercise between the two examiners was performed prior to the main survey. One of the examiners had been previously trained and calibrated for the 2003 Children's Dental Health Survey in the UK and acted as the gold standard examiner for this study. Training for the criteria for the clinical assessment of TDI was carried out through the Oral Health Surveys manual (19) and computer-based practical exercises. Clinical examinations were duplicated in 50 adolescents to test for reliability in the identification of TDI. Kappa values for intra-examiner reliability were 0.87 and 0.91, and that for inter-examiner reliability was 0.80.

Statistical analysis

All analysis took into account sampling weights to compensate for unequal probabilities of selection and the complex survey design to adjust standard errors and 95% confidence intervals (CI) accordingly. We first present the demographic, socioeconomic and clinical characteristics of the sample, followed by the distribution of cases with problem behaviour according to the SDQ.

TDI prevalence was the outcome measure for analysis, which was coded as 0 for no TDI experience and 1 for TDI experience. The association between SDQ total score and TDI prevalence was assessed in unadjusted and adjusted models using binary logistic regression, as the outcome measure was a dichotomous variable. Odds ratios (OR) were therefore reported. The adjusted model controlled for the effect of demographic (sex, age and ethnicity), socioeconomic (parental employment) and clinical factors (overjet and lip coverage) as these are all established risk factors of TDI experience (1, 2, 22, 23). Similarly, the association of each SDQ domain with TDI prevalence was

assessed in unadjusted and adjusted models using binary logistic regression. The adjusted model controlled for the effect of demographic, socioeconomic and clinical factors.

RESULTS

A total of 1451 15-16 year-old adolescents were invited to participate in RELACHS phase III, of whom 1030 (71%) completed the questionnaire and 975 (67%) were clinically examined. For this study, we analysed data from 794 adolescents with complete information on all relevant variables (casewise deletion). The socio-demographic and clinical characteristics of the sample are shown in Table 1. Overall, 17% of adolescents experienced TDI (70% enamel fracture only, 12% treated dental injury, 7% enamel/dentine fracture, 7% pulp injury and 4% missing tooth due to trauma). Very few participants had increased overjet or inadequate lip coverage (13 and 3 adolescents, respectively). Table 2 shows the distribution of the sample by SDQ total and domain scores. As expected, the prevalence of problem behaviour, both overall and by domain, was around 10%.

Problem behaviour, as indicated by SDQ total score, was significantly associated with TDI in crude and adjusted models (Table 3). Adolescents with problem behaviour were 1.87 (95% Confidence Interval: 1.03-3.37) times more likely to have TDI than their counterparts after adjustment for demographic (sex, age and ethnicity), socioeconomic (parental employment) and clinical characteristics (overjet). Lip coverage was dropped when modelling associations due to the small number of cases. Sex and parental employment were also significantly associated with TDI in the adjusted model. By SDQ domains, having peer problems was positively associated with TDI. In the adjusted model, adolescents having peer relationship problems were 1.78 (95% CI: 1.01-3.14) times more likely to have TDI than those having no peer problems. Conduct Problems, Hyperactivity, emotional Symptoms and Prosocial Behaviour were not significantly related to TDI (Table 4).

DISCUSSION

This study revealed that adolescents with problem behaviour in general and peer relationship problems in particular, were more likely to have TDI as compared to their corresponding counterparts, independent of participants' socio-demographic and clinical characteristics. On the other hand, emotional symptoms, hyperactivity and conduct problems were not associated with TDI in this study.

Some limitations of this study need to be borne in mind when interpreting the present results. First, this study was based on cross-sectional data, and as such, was limited to identifying associations

rather than causal relationships. This is particularly important since some TDI may have occurred before the measurement of problem behaviour in late adolescence. Second, the sample of this study only represents 57% of all participants in the RELACHS phase III, which may raise concerns about the generalizability of the findings. However, the sample was weighted for analysis to compensate for non-response and produce representative estimates. Therefore, the present findings are generalizable to the study population of adolescents in East London. Third, we preferred using the SDQ over other instruments (like the Child Behaviour Checklist or CBCL for instance) to assess adolescents' problem behaviour. The SDQ is a brief behavioural screening questionnaire that takes only 5 minutes to complete. It has good psychometric properties and has been validated for use among adolescents in the UK (9). It was also used in all previous dental studies, thus enhancing comparability. Future studies could use alternative instruments to corroborate the present results. Fourth, we used adolescents as informants of problem behaviour. The SDQ has alternative formats which can be completed by parents or teachers, thus allowing for triangulation of sources. Future studies could use multiple informants to increase the credibility of the findings. Fifth, TDI was recorded based on visible signs of trauma (1). Although diagnostic aids (radiographs, vitality tests or trans-illumination) are useful to identify root fractures and luxation injuries (24), they are rarely available in epidemiological surveys. Furthermore, injuries to the tooth-supporting structures are not included in the classification because they do not leave any visible markers. Therefore, the prevalence of TDI in this population is probably underestimated, which in turn could have affected our ability to identify other significant associations. However, our prevalence estimate was slightly higher than the 13% found among 15-year-olds in the 2003 UK national survey (25).

The present findings corroborate those found by the only previous study exploring the association between problem behaviour and TDI, which was also conducted among adolescents in East London (13). Although a stronger study design (case-control) was used in that study, our population-based study has more external validity (generalisability) than a hospital-based study. Peer relationship problems may include issues of isolation, insecurity, low self-esteem and arguments with other friends. These might lead into intentional or unintentional fighting among children. Violence may in turn result in children getting injured especially in the region of the face – where they are more likely to be hit. The teeth, especially the maxillary incisors, are more prone to face a direct blow, thereby resulting in TDI. The peer problems domain in the SDQ includes an item on being picked on or bullied by other

children. Although an association between bullying and TDI has been previously speculated (13, 26), a recent cross-sectional study using data from RELACHS found no association between the two (17).

Our findings did not show an association between other SDQ domains and TDI. That TDI was related to peer problems but not to conduct problems (which included an item about fighting with and bullying other children) could be explained by the fact that children with conduct problems may be the aggressors rather than the victims of violence (13). On the other hand, previous studies have shown that hyperactive children were more likely to get involvement in both major and minor accidents (9-11). However, hyperactivity was not related to TDI in this or the study by Odoi, Croucher, Wong and Marcenes (13). Taken together, these findings suggest that hyperactive children may be more involved in accidents and injuries, but those might not necessarily lead to dental trauma.

Of note is the fact that only few adolescents in the sample had increased overjet and inadequate lip coverage upon clinical examination. This could be due to the high threshold used for identification (greater than 6 mm) which would be relatively difficult to find in a population-based sample (as opposed to in a hospital-based sample). It is also possible that schoolchildren with such extreme dentofacial traits had already received orthodontic treatment by 15-16 years of age.

This study adds TDI to the list of possible consequences of peer relationship problems during late adolescence. Subject to further corroboration in alternative settings and other populations, the present findings could be used to inform policies to address peer relationship problems. Further research is needed to understand where and how TDI occur in order to design preventive programmes.

To conclude, this study corroborates earlier findings suggesting that problem behaviour is independently related to TDI among adolescents. In particular, adolescents who reported peer relationship problems were more likely to have experienced TDI. Further research should determine the types of peer problems that predispose to TDI.

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Table 1. Characteristics of the participants (n=794)

Characteristics	**n**[a]	**(%)**
Sex		
Male	360	43.1%
Female	434	56.9%
Age		
15years	335	42.7%
16 years	459	57.3%
Ethnicity		
White	198	26.2%
Asian	333	40.6%
Black	169	22.3%
Mixed/other	94	10.9%
Parental employment		
One/both employed	526	66.8%
Both unemployed	268	33.2%
Overjet		
Up to 6 mm	781	98.6%
More than 6 mm	13	1.4%
Lip coverage		
Adequate	791	99.8%
Inadequate	3	0.2%
TDI		
No	662	83.1%
Yes	132	16.9%

[a] The number of participants in each category is un-weighted. All other estimates are weighted.

Table 2. Description of the sample by the Strengths and Difficulties Questionnaire (SDQ) domain and total scores in 794 15-16-year-old adolescents from East London

SDQ domains	Case		Non-Case	
	n[a]	%	n[a]	%
Conduct problems	102	12.7%	692	87.3%
Hyperactivity	87	10.9%	707	89.1%
Emotional symptoms	119	15.2%	675	84.8%
Peer problems	81	10.8%	713	89.2%
Pro-social behaviour	50	6.1%	744	93.9%
SDQ total	81	10.0%	713	90.0%

[a] The number of participants in each category is un-weighted. All other estimates are weighted.

Table 3. Association between the Strengths and Difficulties Questionnaire (SDQ) total score and traumatic dental injuries (TDI) in 794 15-16-year-old adolescents from East London

Explanatory Variables	% TDI	Unadjusted models		Adjusted model[b]	
		OR[a]	(95% CI)	OR[a]	(95% CI)
SDQ total score					
Non-case	16%	1.00	(Reference)	1.00	(Reference)
Case	27%	1.99	(1.13-3.50)*	1.87	(1.03-3.37)*
Sex					
Male	21%	1.00	(Reference)	1.00	(Reference)
Female	14%	0.59	(0.39-0.87)**	0.55	(0.37-0.82)**
Age					
15 years	15%	1.00	(Reference)	1.00	(Reference)
16 years	19%	1.36	(0.91-2.05)	1.29	(0.85-1.95)
Ethnicity					
White	19%	1.00	(Reference)	1.00	(Reference)
Asian	16%	0.78	(0.47-1.28)	0.64	(0.38- 1.07)
Black	14%	0.68	(0.38-1.24)	0.71	(0.39-1.29)
Mixed/other	23%	1.28	(0.68-2.42)	1.19	(0.61-2.29)
Parental employment					
One/both employed	15%	1.00	(Reference)	1.00	(Reference)
Both unemployed	21%	1.54	(1.03-2.31)*	1.71	(1.11-2.63)*
Overjet					
Up to 6 mm	17%	1.00	(Reference)	1.00	(Reference)
More than 6 mm	18%	1.11	(0.24-5.18)	1.16	(0.28-4.85)

[a] Logistic regression was used for testing associations and odds ratios (OR) reported.
[b] Adjusted for gender, age, ethnicity, parental employment and overjet.
* p<0.05; ** p<0.01; *** p<0.001

Table 4. Association between the Strengths and Difficulties Questionnaire (SDQ) domain scores and traumatic dental injuries (TDI) in 794 15-16-year-old adolescents from East London

Problem behaviour	% TDI	Unadjusted models		Adjusted models[b]	
		OR[a]	(95%CI)	OR[a]	(95%CI)
Conduct problems					
Non-case	17%	1.00	(Reference)	1.00	(Reference)
Case	16%	0.96	(0.53-1.75)	0.82	(0.44-1.50)
Hyperactivity					
Non-case	17%	1.00	(Reference)	1.00	(Reference)
Case	15%	0.85	(0.44-1.63)	0.76	(0.38-1.51)
Emotional symptoms					
Non-case	17%	1.00	(Reference)	1.00	(Reference)
Case	18%	1.08	(0.63-1.85)	1.14	(0.65-1.98)
Peer problems					
Non-case	16%	1.00	(Reference)	1.00	(Reference)
Case	26%	1.89	(1.08-3.30)*	1.78	(1.01-3.14)*
Pro-social behaviour					
Non-case	17%	1.00	(Reference)	1.00	(Reference)
Case	23%	1.49	(0.71-3.14)	1.36	(0.61-3.02)

[a] Logistic regression was used for testing associations and odds ratios (OR) reported.
[b] Adjusted for gender, age, ethnicity, parental employment and overjet.
* p<0.05; ** p<0.01; *** p<0.001